INSTRUCTION MANUAL
FOR
TTS 18 SERIES OF
THREE-RANGE LEVEL
MEASURING SETS

18B

NORTHEAST ELECTRONICS CORPORATION

P. O. BOX 649 – CONCORD, N. H. 03301

NORTHEAST ELECTRONICS CORPORATION
Concord, New Hampshire

MODELS TTS 18B AND TTS 18E
THREE-RANGE LEVEL MEASURING SETS

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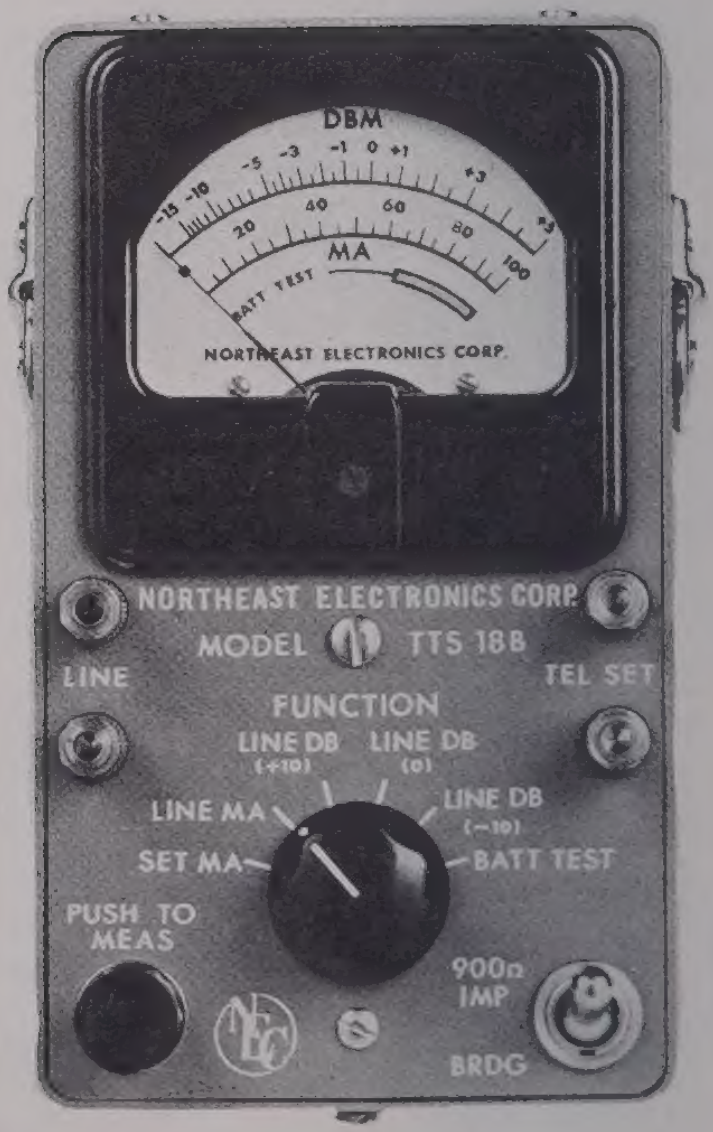

DBM
-15 -10 -5 -3 -1 0 +1 +3 +5
20 40 60 80 100
MA
BATT TEST
NORTHEAST ELECTRONICS CORP.
NORTHEAST ELECTRONICS CORP.
MODEL TTS 18B
LINE
TEL SET
FUNCTION
LINE DB (+10)
LINE DB (0)
LINE MA
LINE DB (-10)
SET MA
BATT TEST
PUSH TO MEAS
900Ω IMP
BRDG

FIG. 1

MODELS TTS 18B and TTS 18E
THREE-RANGE LEVEL MEASURING SETS

OPERATING INSTRUCTIONS

1.0 GENERAL

1.01 The Model TTS 18 is a compact, self powered, level and DC current measuring set. It was specifically designed for use on subscriber loops in offices where a milliwatt reference generator can be dialed from the subscriber location. In view of its high degree of sensitivity the set can be used for measurements on many other circuits, such as toll circuits, PBX circuits, etc. The set provides both terminated and bridging operation. The TTS 18B is calibrated for 900 ohm impedance and the TTS 18E is calibrated for 600 ohm impedance.

1.02 The unit measures $3\frac{1}{2}$" x 6" x $2\frac{1}{2}$" and weights 3 3/4 pounds. The set is powered by an Eveready #226 or equivalent 9-volt battery. An optional leather case and carrying strap is available.

1.03 The face view of the unit is shown in Fig. 1, the overall schematic in Fig. 2.

2.0 PERFORMANCE DATA

2.01 Input Impedance

Terminated: TTS 18B - 900 ohms
TTS 18E - 600 ohms

Bridging: In excess of 15,000 ohms

DC Blocking: AC coupling is provided to the input amplifier to prevent damage from DC voltages up to 200 vdc.

2.02 Current Measuring

Range of Measurement: 0-100 mA

Impedance: 10 ohms across line terminals in the LINE MA position of FUNCTION switch. 10 ohms in series with the circuit connected to the TEL SET terminals and the SET MA position of the FUNCTION switch.

Accuracy: ± 2% of full scale

2.03 Meter Scale

DB Scale: TTS 18B - 0.5 dB steps from +5 to -5 dB
1.0 dB steps from -5 to -15 dB

TTS 18E - 0.5 dB steps from 0 to -10 dB
1.0 dB steps from -10 to -20 dB

MA Scale: 0 to 100 mA in 5 mA divisions

BATT TEST Scale: A green arc for correct voltage

The meter can withstand continuous 50% overload (150 mA).

2.04 AC Sensitivity

TTS 18B - Sensitivity from +15 to -25 dB in three ranges
+15 to -5 dB
+5 to -15 dB
-5 to -25 dB

TTS 18E - Sensitivity from +10 to -30 dB in three ranges

+10 to -10 dB
0 to -20 dB
-10 to -30 dB

2.05 Stability of Calibration

Changes referred to measurements at 70°F on representative set.

Temperature Errors: Typical performance at 0 dB on meter, ±0.2 dB from 40° to 120°F.

Supply Voltage Errors: Typical performance at 0 dB on meter, ±0.1 dB at battery cut off.

2.06 Frequency Response

±0.2 dB from 300 cps to 3000 cps

±1.0 dB from 100 cps to 100 Kc

2.07 Battery

Battery life 140 hours continuous use; 200 hours 4 hours use per day.

3.0 CIRCUIT DESCRIPTION

3.01 The amplifier driving the meter is a conventional transistor amplifier using PNP transistors. The rectifier bridge which supplies DC to the meter is inserted in the amplifier feedback path. The use of negative feedback provides stability of the effective gain with variations of temperature and battery voltage.

3.02 The PUSH TO MEAS switch is normally released. In this position the internal battery supply is interrupted and the TEL SET terminals are directly connected to the LINE terminals. Thus, an externally connected telephone set can be used to dial the number of the central office reference level generator. Any other suitable transmission test equipment connected to the distant end of the circuit may be used to provide a 1 milliwatt signal. In the released position of the PUSH TO MEAS switch the external telephone set will provide all normal talking and dialing features.

3.03 When the PUSH TO MEAS switch is depressed, the direct connection between the line and the telephone set is interrupted and the line circuit is transferred to one of the arms of the FUNCTION switch. Simultaneously the battery for the transistor amplifier used in the level measuring functions is connected and a circuit is established connecting the TEL SET to the amplifier circuit for monitoring purposes.

3.04 A toggle switch is provided to transfer the set from "terminated" to a 15,000Ω "bridged" operation.

3.05 A rotary FUNCTION switch is provided to select the six measuring functions which can be performed by this set. These measuring circuits are activated when the PUSH TO MEAS switch is depressed. The PUSH TO MEAS switch can be locked in the depressed position by turning the pushbutton 90°.

3.06 In the SET MA position of the FUNCTION switch, the TTS 18 connects the TEL SET terminals directly to the LINE terminals through a 10Ω resistor, and it measures the DC current through the externally connected telephone set. The current is the transmitter current in a subscriber set connected to the TEL SET terminals. The meter range is 0-100 mA. If the meter deflects in the wrong direction, it is necessary to reverse the connections between the set and the line.

3.07 In the LINE MA position of the FUNCTION switch, the TTS 18 interrupts the circuit across the TEL SET terminals, connects a 10Ω resistor across the LINE terminals, and measures the DC current in the 10Ω resistor. This is the DC short circuit current of the line under test. The meter range is 0-100 mA. The DC polarity requirements for this test are the same as those in paragraph 3.06.

3.08 In the LINE DB (+10) position of the FUNCTION switch the level measuring circuit of the TEL SET terminals is connected directly to the LINE terminals. In the BRDG position of the IMP switch the impedance of this circuit is at least 15,000 ohms. In the 900 ohm (600 ohm for TTS 18E) position of the IMP switch the AC termination presented at the LINE terminals is 900 ohms (600 ohms for TTS 18E) and the DC resistance which provides holding features for the circuit is 945 ohms (630 ohms for TTS 18E).

3.09 In the LINE (0) position of the FUNCTION switch the circuit is identical to the one described above except that the sensitivity of the level measuring circuit is increased by 10 dB.

3.10 In the LINE DB (-10) position of the FUNCTION switch the circuit is identical to the one described above except that the sensitivity of the level measuring circuit is increased by 10 dB.

3.11 In the BATT TEST position the TTS 18 measures the voltage of the internal battery. Meter readings in the green arc of the scale marked BATT TEST indicate that the battery voltage is satisfactory.

4.0 SWITCHES AND TERMINALS

4.01 **Function Switch:** A rotary switch which selects one of the six measuring functions performed by the TTS 18B.

4.02 **Push to Measure Switch:** A pushbutton switch which, in the released position, provides all normal talking and dialing features. In the depressed condition it transfers the LINE terminals to the FUNCTION switch for measuring purposes and, depending upon the FUNCTION switch position, transfers the TEL SET terminals to the amplifier circuit for monitoring or to the current measuring circuit.

4.03 900 OHM IMP-BRDG: A toggle switch to transfer the set from a 900 ohm "terminated" to a 15,000 ohm "bridged" operation

4.04 LINE Terminals: Provides for connection of the line circuit to the unit for level and current measurements

4.05 TEL SET Terminals: Provides for connection of external telephone set for dialing through the unit and measuring TEL SET current. Also provides for monitoring while measuring level on the line.

5.0 CALIBRATION

5.01 The calibration of the instrument may be checked by connecting it to a 0 level source of proper impedance. The meter should read 0 dBm. If it does not, first check whether the mechanical zero is at the specified point in the absence of any signal. If it is not, readjust the mechanical zero. If the meter still does not read 0 dBm, change the setting of R8 on the internal circuit board until a 0 reading is obtained.

6.0 OPERATION

6.01 To make measurements on a subscriber line, proceed as follows:

1. Make sure that the PUSH TO MEAS button is in the released position. If it is found locked in the ON position, perform a battery test as under paragraph 6.03.

2. Turn the FUNCTION switch to the SET MA position.

3. Connect the LINE terminals of the TTS 18 to the line to be tested. Connect a telephone set to the TEL SET terminals of the TTS 18. This may be the subscriber set for tests on subscriber circuits. The telephone set is now connected to the line.

4. Dial the subscriber number to which the milliwatt generator at the central office is connected and observe that the reference tone is being received.

5. Depress the PUSH TO MEAS switch, observe and note the DC set current. Note: If the meter reading is reversed, reverse the leads on the LINE terminals and repeat steps 4 and 5.

6. Move the FUNCTION switch to the LINE MA position, depress the PUSH TO MEAS switch, observe and note the DC line current.

7. Move the FUNCTION switch to one of the three LINE DB positions and depress the PUSH TO MEAS switch Select the range which gives the greatest deflection without driving the meter off scale. Observe and note the received level. This level measures the circuit loss if the send level of the milliwatt generator is 0 dBm.

8. In the first LINE DB position (marked +10), the level is 10 dB higher than indicated on the meter scale; thus a meter indication of -7 corresponds to -7 +10 = +3 dB. In the second LINE DB position (marked 0) no correction to the meter reading is necessary. In the third LINE DB position (marked -10) the actual level is 10 dB lower than the meter indication. Thus, an indication of -4 dB corresponds to -14 dB.

9. Restore the FUNCTION switch to the SET MA position and release the PUSH TO MEAS switch.

6.02 General Transmission Measurements - To use the TTS 18 as a level measuring set for other than subscriber line use, proceed as follows:

1. Make sure that the PUSH TO MEAS switch is in the released position. If it is found locked in the ON position, perform a battery test as under paragraph 6.03.

2. Select either the terminated or bridging operation, as required, by means of the toggle switch.

3. Turn the FUNCTION switch to the LINE DB position, which gives a convenient meter reading (see paragraph 6.01.7) depress and lock the PUSH TO MEAS switch and observe and note the received level. This is the level delivered by the circuit under test into a termination or the level measured on a bridging basis, dependent on the position of the toggle switch.

6.03 Battery Test - Move the FUNCTION switch to the BATT TEST position and depress the PUSH TO MEAS switch. The meter indication should fall within the green arc on the BATT TEST scale. If the meter is below the green scale, the battery should be replaced.

7.0 MAINTENANCE

7.01 The condition of the battery should be checked daily when the instrument is in regular use. The checking procedure is given in paragraph 4.03

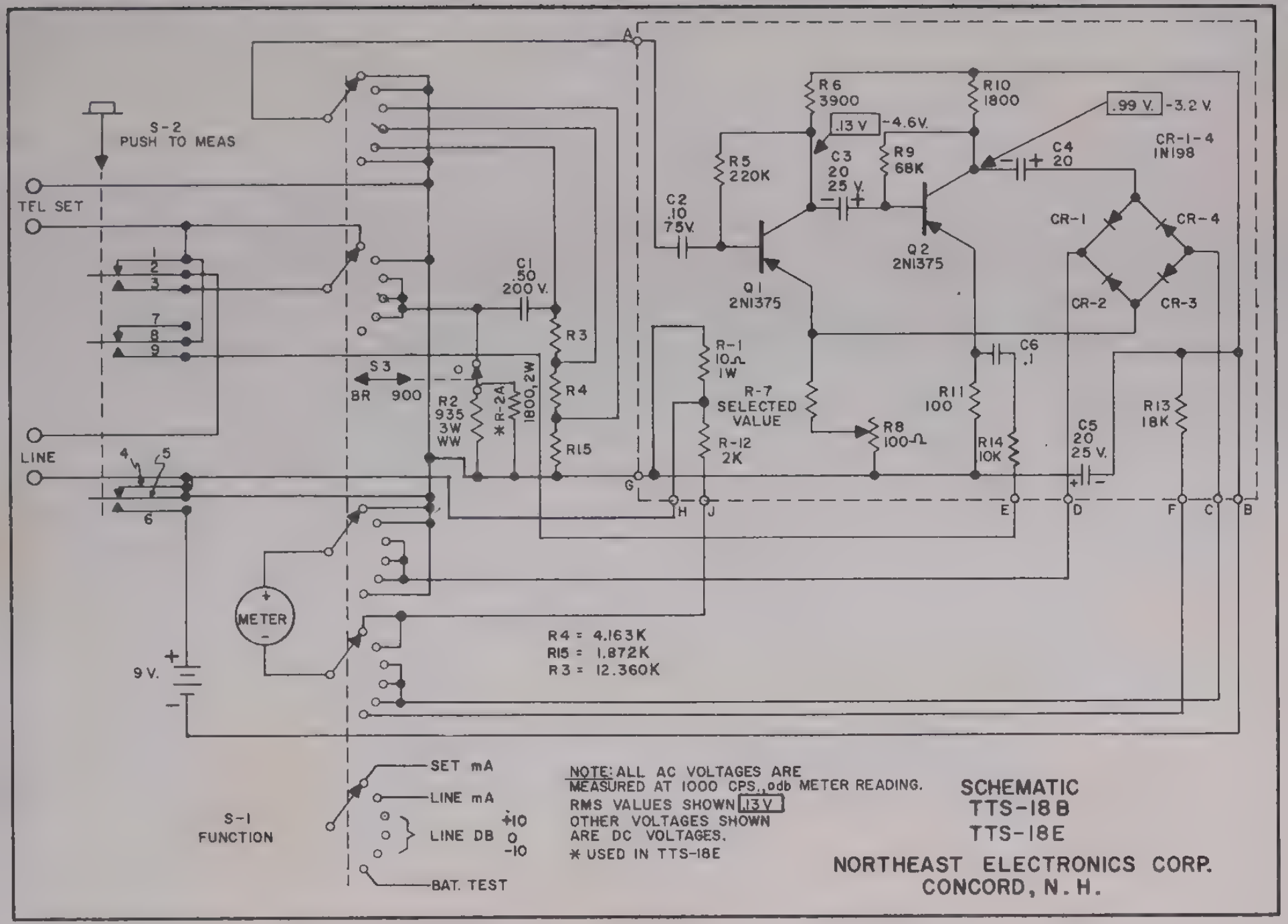

S-2
PUSH TO MEAS
TEL SET
LINE
1
2
3
4
5
6
7
8
9
S3
BR
900
C1
.50
200 V.
R2
935
3W
WW
*R-2A
1800, 2W
R3
R4
R15
R-1
10Ω
1W
R-7
SELECTED
VALUE
R-12
2K
R8
100Ω
C2
.10
75V.
R5
220K
R6
3900
.13 V
-4.6V.
C3
20
25 V.
R9
68K
R10
1800
.99 V.
-3.2 V.
C4
20
CR-1-4
IN198
Q1
2N1375
Q2
2N1375
CR-1
CR-2
CR-3
CR-4
C6
.1
R11
100
R14
10K
C5
20
25 V.
R13
18K
A
B
C
D
E
F
G
H
J
METER
9 V.
R4 = 4.163K
R15 = 1.872K
R3 = 12.360K
S-1
FUNCTION
SET mA
LINE mA
LINE DB
+10
0
-10
BAT. TEST
NOTE: ALL AC VOLTAGES ARE MEASURED AT 1000 CPS., odb METER READING.
RMS VALUES SHOWN .13 V
OTHER VOLTAGES SHOWN ARE DC VOLTAGES.
* USED IN TTS-18E
SCHEMATIC
TTS-18B
TTS-18E
NORTHEAST ELECTRONICS CORP.
CONCORD, N. H.

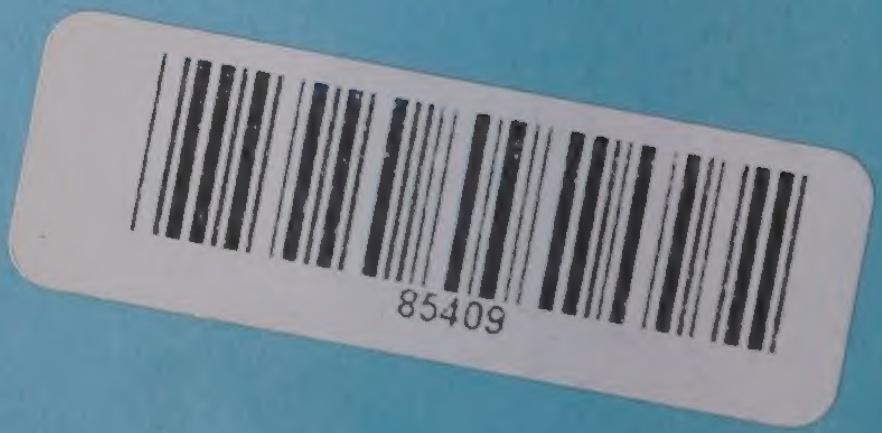
FIG.-2

TABLE OF REPLACEABLE PARTS

Ref Desig.	Description	Manufacturer (FSCM Code #)	Part Number
C1	C: fxd ppr 0.5μF 200V	00656	P8292ZN12
C2	C: fxd ceramic 0.1μF 75V	71590	DDA-104
C3 - C5	C: fxd elect 20μF 25V	09653	APD-046
C6	C: fxd ceramic 0.1μF 75V	71590	DDA-104
R1	R: fxd comp 10Ω ±5% 1W	01121	GB1005
R2	R: fxd ww 935Ω ±1% 3W	13606	242E114A
R2A	R: fxd ww 1.8K ±1% ½W	13606	243E1825
R3	R: fxd mf 12.36K ±1% ½W	07716	CEATO
R4	R: fxd mf 4.163K ±1% ½W	07716	CEATO
R5	R: fxd comp 220K ±10% ½W	01121	EB2241
R6	R: fxd comp 3.9K ±5% ½W	01121	EB3925
R7-R7A	R: fxd comp sel val		
R8	Pot: var 100Ω	90201	MTC-4
R9	R: fxd comp 68K ±5% ½W	01121	EB6835
R10	R: fxd comp 1.6K ±5% ½W	01121	EB1825
R11	R: fxd comp 100Ω ±10% ½W	01121	EB1011
R12	R: fxd comp 2K ±5% ½W	01121	EB2025
R13	R: fxd comp 18K ±5% ½W	01121	EB1835
R14	R: fxd comp 10K ±10% ½W	01121	EB1031
R15	R: fxd metal film 1.872K ±1% ½W	07716	CEATO
S1	S: rotary (FUNCTION)	76854	Special
S2	S: pushbutton (PUSH TO MEAS)	82389	3S1364
S3	S: toggle SPST (IMP-BRDG)	04009	20994-LH
	Knob: for switch S1	75376	S-647-3L-BB
Q1-2	Transistors	01295	2N1375
CR1-4	Diodes	80368	1N198
J1-4	Binding posts	83330	137SP
	Meter	06819	Special
	Battery: 9 volt (1 per set)	25312	226

FSCM CODE NUMBERS

Code #	Manufacturer
00656	Aerovox Corporation
01121	Allen Bradley
01295	Texas Instruments
04009	Arrow-Hart & Hegeman
06819	Northeast Electronics Corporation
07716	IRC
09653	IEI
13606	Sprague
25312	Eveready
71590	Centralab
75376	Kurz-Kasch, Inc.
76854	Oak Manufacturing Co.
80368	Sylvania Electric Products, Inc.
82389	Switchcraft, Inc.
83330	H. H. Smith
90201	P. R. Mallory Company, Inc.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